REMARKS

Claims 1-64 are currently pending. Claims 1, 24, 35, and 44 have been amended to clarify them. Claim 61-64 have been added. Support for the new claims 61-64 is found in the specification, page 13, paragraph [0043]. Applicants respectfully request reconsideration of the application in response to the final Office Action.

Allowable Subject Matter

Applicants gratefully acknowledge the indication by the Examiner that claims 20-23, 59, and 60 are allowable.

Claim Rejections – 35 U.S.C. §103(a)

Claims 1-19 and 35-43 have been rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Lam et al. (US 6,956,653) and in view of Kachanov (US 5,543,916).

In rejecting claims 1 and 35, the Office has conceded "Lam teaches the interferometer is useful for characterizing input light (column 1, line 11) and gives several different examples in which the interferometer can be used but does not expressly show the interferometer being used to measure the wavelength of the light." Then, to overcome the deficiency in teaching the interferometer being used to measure the wavelength of the light, the Office has relied on the second reference as follows: "Kachanov shows an interferometer for determining wavelength wherein the interferometer uses two point sources of light similar to Lam's waveguide ends to create an interference pattern ... At the time of the invention, one of ordinary skill in the art would have used the interferometer of Lam in order precisely monitor the wavelength of a laser light since Kachanov shows the motivation to measure the wavelength of light." Applicants respectfully disagree.

The Lam et al. patent relates to a dual electrooptic waveguide interferometer (DEWI). The DEWI includes two electrodes that are respectively positioned parallel to two waveguides. Applying voltages to the electrodes affects the optical phases of the optical signals in the associated waveguides. The DEWI system measures the location of the null in the fringe pattern generated by two output beams that has

respectively passed through the two waveguides. Then, based on a predetermined relation between the location and input voltage, the input voltage corresponding to the measured location is determined.

As correctly noted by the Office, the Lam et al. patent does not expressly teach that the interferometer is used to measure the wavelength of the light. The Lam et al. system is based on the assumption of an ideal interferometer, that is, that electrodes 210 and 212 are identical and waveguides 218 and 220 have the same optical lengths (col. 5, l. 32-35). The Lam et al. patent further discloses that "[f]or an ideal interferometer applying the same voltages to electrodes 210 and 212 would induce the same optical phase changes on the optical signals in corresponding waveguide 218 and 220. (col. 5, l. 36-40)" Apparently, the physical path lengths of the two waveguides 218 and 220 need to be identical to make the Lam et al. system work. Also, in the Lam et al. system, the electrodes typically vary the optical path length difference between the waveguides by few wavelengths of light (approximately 0.001 mm) at the most. In marked contrast, the presently claimed invention would not work properly if the physical path lengths are identical. For instance, the first and second optical paths have a physical path length difference of 2.33 mm, or equivalently, 2,500 wavelengths (page 10, paragraph [0032]). Thus, the Lam et al. system cannot be used to measure the wavelength in the sense of the present application.

A skilled artisan would easily appreciate that the Lam et al. device cannot be used to accurately measure the wavelength because of its small order number. This can be seen from Equation 4 in the specification, paragraph [0022], which can be re-written as

$$x = \frac{nL\lambda}{s},$$

where x is the position of a fringe, and n is the order number. The wavelength is proportional to the fringe position, which is measured by the photo sensors. In order to determine the wavelength with sufficient accuracy, the change in fringe position with wavelength needs to be large. The sensitivity of the fringe position with respect

to the wavelength, λ, is found by differentiating the above equation and represented by

$$\frac{\partial x}{\partial \lambda} = \frac{nL}{s}.$$

This equation shows that the change in x with wavelength is proportional to the order number. Typically, in Young's interferometer and in Lam's interferometer, the order number is zero or very near zero, and the position of the fringe is nearly independent of the wavelength. Therefore the fringe position provides, at best, only a crude estimate of the wavelength. On the other hand, in certain embodiments of the present invention, the order number is near 2500 (paragraph [0033]) because of the optical path difference in the two arms, so the change in position of the fringe with wavelength is much greater. This enables accurate measurements of the wavelength with a precision of near 1 part per million, as described in the specification, paragraph [0033].

The Kachanov shows an interferometer for determining wavelength wherein the interferometer does use two point sources of light to create an interference pattern. However, the Kachanov system has fundamental differences compared to the Lam et al. system. In the Kachanov system, the two point sources of light are not located in a common plane normal to the direction of propagation of the central light rays emitted from two output ports, resulting curved fringes. In contrast, the fringes formed by the Lam et al. system may have a substantially straight line shape. In addition, the two point sources of the Kachnov system are generated by reflections off the front and rear surfaces of an interferometer that has a substantially flat plate shape, while the Lam et al. system uses an optical divider to generate two light sources. Furthermore, the Kachanov system does not include waveguides of the Lam et al. system, much less the electrodes that are positioned substantially parallel to the waveguides. Accordingly, the structure and operational mechanism of the Kachanov system are significantly different from those of the Lam et al. system.

To state the argument differently, it is not obvious how to replace the plate shaped interferometer of the Kachanov system with the Mach-Zender type

waveguides of the Lam et al. system. The undersigned can find no disclosure in the cited references that would motivate a skilled artisan to combine the teachings to arrive at the Applicants' claimed invention. Also, the Kachanov patent is silent as to the optical path length difference. As such, even if the teachings of Lam et al. and Kachanov patents were combined, the hypothetical combination of the teachings cannot be used to measured the wavelength in the sense of the present application.

For emphasis of the original claim recitations, claims 1 and 35 have been amended and respectively include recitations " first and second optical paths ... which have physical path lengths which differ by a preset amount to yield a first optical length difference therebetween " and "said two waveguide paths having physical path lengths which differ by a preset amount to yield an optical path length difference therebetween." Support for the change can be found in the specification, page 7, paragraph [0026], for example. A review of the cited reference reveals that the cited references fail to teach the recitations. Based on the recitations and the reasons set forth above to address the asserted combination of the teachings, Applicants respectfully submit that a *prima facie* case of obviousness has not been established, and claims 1 and 35 are patentable. Claims 2-19 and 36-43 depend from claims 1 and 35, rendering them also patentable for at least the same reasons.

In rejecting claim 10, the Office has stated that "one of ordinary skill in the art would have optimized for the proper working range of knowing the relationship of the fringe spacing to the wavelength...as is known by the teaching of Young...." Applicants respectfully disagree.

It appears that the Office has viewed the two apertures of Young's interferometer to correspond to the two output ports of the presently claimed invention. As is well known in the art, Young's interferometer has two apertures that transmit two light beams, wherein the two light beams have the same phase at the apertures. In contrast, claim 10 is directed to an apparatus that includes two optical paths having an optical length difference therebetween, wherein the optical length difference is a physical length difference of about 2.33 mm. Thus, two light beams

that respectively pass through the two optical paths and thence exit through the two output ports would have a phase difference commensurate with the optical length difference. As such, Applicants respectfully submit that Young's interferometer is not a relevant prior art for the apparatus that claim 10 is directed to.

Claim 24 has been amended to include a recitation "said two waveguide paths having physical path lengths which differ by a preset amount to yield an optical path length difference therebetween." Based on the same reasons set forth above to address the rejection of claims 1 and 35, Applicants respectfully submit claim 24 and its dependent claims 25-34 are patentable.

Claims 44-58 have been rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Lam et al. and Kachanov as applied to claim 1 above, and further in view of Snyder (US 4,173,442).

This rejection is predicated on the erroneous characterization of the Lam et al. and Kachanov patents, and is respectfully traversed, as pointed out above. Furthermore, claim 44 has been amended to include "first and second optical paths ... which have physical path lengths which differ by a preset amount to yield a first optical length difference therebetween." Accordingly, Applicants respectfully submit that the rejection of claim 44 and its dependent claims, claims 45 - 58, lacks foundation and must be withdrawn.

Conclusion

Based on the reasons as set forth above, Applicants respectfully request allowance of all pending claims.

In the event that there are any questions concerning this paper, or the application in general, the Examiner is respectfully urged to telephone Applicants' undersigned representative so that prosecution of the application may be expedited.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY LLP

Date: November 9, 2006 By: C. Park

Chung S. Park
Registration No. 52093

P.O. Box 1404
Alexandria, VA 22313-1404
650 622 2300